

## EXECUTIVE SUMMARY

Statistics show that there is a positive correlation between research, innovation, and U.S. economic prosperity.<sup>1</sup> In general, research and development (R&D) expenditures in the U.S. are increasing. Total U.S. investment in R&D was approximately \$264 billion in 2000. Since the 1980s, industry's investment in R&D has been increasing, reaching about \$179 billion in 2000. The Federal Government is a major sponsor of R&D in the U.S. providing approximately \$83 billion in funding in 2000 of which the Department of Defense (DoD) portion was approximately \$39 billion.<sup>2</sup> The number of U.S. patents, including federal as well as non-federal, is continuing to rise reaching nearly 155,000 in 1998.<sup>3</sup> Patent licensing revenue was well over \$100 billion in 1998 and experts predict that the licensing of patents is a practice still in its infancy. These experts also predict that revenues could exceed a half-trillion dollars within the next five years.<sup>4</sup>

Trends have emerged over the last several years that significantly affect the accessibility of DoD research to the private sector. DoD R&D, as well as that of the Federal Government as a whole, leads to the creation of new products and processes that can be patented and commercialized. Licensing DoD technologies is a technology transfer mechanism that industry can use to gain access to DoD inventions and further develop them into commercial products. The purpose of technology transfer is to make federally generated scientific and technological developments accessible to private industry and the state and local governments. The users are then encouraged to develop the technology further into new products, processes, materials, or services that will enhance the nation's industrial competitiveness or otherwise improve the nation's quality of life. In licensing technology for commercial applications, it is envisioned that economies of scale will result, therefore decreasing the purchase price of components using the same technology for military applications.

Legislation is increasingly encouraging the licensing of DoD technologies by the private sector. Legislation that first impacted patenting activities in DoD was the Stevenson-Wydler Technology Innovation Act of 1980 which permitted DoD to negotiate license agreements for inventions developed in their laboratories. This act was followed by the Federal Technology Transfer Act of 1986 which authorized DoD laboratories to waive the right of ownership which the Federal Government may have to any subject invention made by a collaborating party, furthering the appeal of establishing working relationships between the private sector and DoD. The National Technology and Advancement Act of 1995 revised provisions regarding title to intellectual property arising from Cooperative Research and Development Agreements (CRADAs), allowing the collaborating party to choose an exclusive license for a pre-negotiated field of use for any invention developed under the agreement. Most recently, the Technology Transfer Commercialization Act of 2000 further improves the ability of Federal laboratories to license federally owned inventions by providing for public notification for at least 15 days before a license is granted. It also sought to simplify the procedures for private industry to license federally developed technologies. In addition, it requires that the applicant make a commitment to achieve practical utilization of the invention within a reasonable time and requires periodic reporting on the use of the invention by the licensee.

The DoD Technology Transfer Program ensures that the best possible use of national scientific and technical capabilities is carried out to enhance the effectiveness of DoD forces and systems. The Program promotes domestic technology transfer through U.S. and foreign patenting, patent

licensing, and protecting other intellectual property rights. The DoD Directive on Domestic Technology Transfer states that DoD inventions applicable for licensing shall be publicized to accelerate transfer of technology to the domestic economy. The DoD Instruction states that patents are one of the original instruments of technology transfer and represent one of the clearest means to characterize an innovation and to describe how it may be of benefit to the user.

For this study, the Office of the Secretary of Defense, Director Defense Research and Engineering (DDR&E) is interested in understanding what is being accomplished through the licensing of DoD technologies and the impact licensing is having on the DoD laboratory missions. It is inherent that the marketing of patents is directly related to the number of patent license agreements (PLAs) negotiated in a given year. Therefore, there is interest in learning what patent marketing approaches are being used in the various DoD labs and what successful approaches other Federal laboratories and academia are using that may be applicable to DoD. In addition, with declining laboratory budgets, it is not feasible that payment of maintenance fees on all patents can continue. Laboratories need to have a patent prioritization process in place to prune those patents that may not be in their best interest to have in their portfolio. Therefore, DDR&E is interested in documenting and sharing practices in this area.

Aside from the revenues that are realized by DoD laboratories by licensing their inventions, there is widespread belief that patenting and licensing promotes innovation and knowledge sharing. Inventions can build on one another, therefore leading to new innovations. The marketing of patents is an important function, for marketing not only brings in revenue to the laboratories in the form of royalties, but also incentivizes inventors by allowing them to share in the royalty income and promotes innovation from which new inventions can be born.

As patenting remains relatively stable in the DoD laboratories, licensing too has remained stable. However, it is envisioned that with more aggressive patent marketing by the DoD laboratories that licensing could increase, leading to an increase in royalty income for the labs.

Since it was not practical to evaluate all PLAs currently active in DoD, each Service was asked to provide candidate PLAs for this study. The candidate PLAs should not be viewed as exemplary in nature by their nomination, but rather were selected based on factors such as the accessibility of the inventor, whether royalty income is being generated, and whether the PLA is currently active. In addition, a selection of Office of Research and Technology Applications (ORTA) representatives was chosen from each of the Services to be interviewed on their respective patent marketing efforts and patent prioritization methodologies. Select academic licensing models were reviewed, for they provide an interesting comparison to the Federal labs; both entities focus on basic research which is a long way from commercialization. This selection was based upon availability of points-of-contact as well as those considered to be leaders in this area by their peers. Information gathered in the interviews was used to support the benefits, findings and insights.

Three significant benefits that licensing brings to DoD and three findings on DoD licensing and patent marketing emerged from this study. In addition, there were a number of insights deduced from licensing and patent marketing approaches. These benefits, findings, and insights are presented below.

### *Benefits of Licensing to DoD*

- Licensing can result in COTS products available for purchase by DoD.
- Licensing can lead to the fostering of new working relationships with private industry resulting in furthering R&D. Sometimes these new relationships are solidified via a CRADA.
- Licensing generates revenue back to the laboratories.

### *Findings on DoD Licensing and Patent Marketing Approaches*

- The inventor is the best resource for marketing DoD patented technologies.
- Technologies licensed from DoD are relatively immature and typically require additional resources and time to bring to commercialization.
- Start-up companies are sometimes established to license DoD technologies and bring them to commercialization.

### *Insights on Licensing and Patent Marketing Approaches*

- There is a mix of opinions on the benefits of having patent attorneys located onsite at DoD and non-DoD research institutions.
- Established practices for patent prioritization and invention evaluation are ad hoc in the DoD laboratories.
- DoD laboratories and academic research institutions have had limited success with finding licensing partners via technology exchanges.
- Using brokers as middlemen to match technologies with potential licensees is being considered by some.
- Technology transfer alliances are becoming a valuable resource for marketing DoD patents.
- Performing technology assessments is not widely practiced.
- Listing technologies available for licensing on laboratory web sites is a passive approach to marketing.
- It is not widely known that Montana State University TechLink has had an appropriations budget line, so there is no cost to the DoD labs for using this PI.
- When DoD negotiates a license for the manufacture of a product, it does not always lead to production for a broader use.
- Some inventors perceive that large companies, who have the resources, have the ability to license technologies from DoD for competitive reasons.
- Some inventors are concerned that DoJ does not prosecute DoD patent infringement cases; therefore, industry may believe it is unnecessary to license DoD technologies.
- DoD medical R&D laboratories may benefit from leveraging the services provided by the NIH Office of Technology Transfer.

Due to budget constraints, particularly those that exist in the funding of technology transfer at the DoD laboratories, active marketing of DoD technologies is limited. ORTAs sometime consist of one person and even that one person may have multiple responsibilities outside of the technology transfer duties. Typical efforts by these offices to market technologies such as advertising in trade journals, attending trade shows in relative technology areas, and posting technologies on laboratory web sites are passive approaches that have brought limited success in the licensing of DoD technologies.

One means of enhancing patent marketing activities in the DoD laboratories is to centralize the licensing activities by either Military Service, command, or technology area. Limited budgets make it difficult to support a significant operation at each of the laboratories that can effectively provide all the services that are required in the patenting, licensing, and marketing of DoD technologies. This centralized approach would provide services to the respective DoD laboratories that would include supplying patent attorneys and experienced licensing staff to streamline the patent and licensing activities. This licensing staff would be experienced in specific technology areas and have business backgrounds. This model is similar to that of NIH and the MSU TechLink as well as many of the academic models evaluated in this study.

Johns Hopkins University School of Medicine as well as Harvard Medical School have offices of technology transfer that are distinct from those of their respective universities. In addition to a separate technology transfer office for their medical school, Johns Hopkins University also has a separate office for their Applied Physics Laboratory. These universities are quite diverse in their scientific R&D. Distinct technology transfer offices provide focus in specific technology areas. These medical school models suggest that the licensing of medical technologies involves a specific client base and processes (i.e. FDA regulatory considerations) that are unique. Although the Army Medical Research & Materiel Command and the Naval Medical Research Institute have consolidated the licensing activities of their medical laboratories at the command level, staffing and resources are limited. Therefore, DoD medical R&D laboratories should consider either further consolidating their licensing resources and activities or leveraging, at the command or local level, an established entity such as NIH where the nuances associated with licensing medical technologies can be addressed in an effective manner. NIH has been very successful and has an experienced staff and established contacts that could be leveraged by DoD. It would not be prudent to reinvent the NIH model at the individual medical laboratories, for the ORTAs at these laboratories do not have the resources required to develop such a capability at each location.

Now that technology transfer legislation has been in existence for over 15 years, more and more businesses are looking to DoD for technological expertise. As legislation increasingly encourages the licensing of DoD technologies, licensing activity will increase, thereby increasing royalty revenue back to the laboratories. It is possible that this increase in revenue will enable the ORTA functions at the various DoD laboratories to be cost reimbursable. As permitted and outlined in the DoD Directive and Instruction, this revenue stream can not only assist in enhancing technology transfer activities, but can also enhance partnering with industry and provide additional funding for those technology areas in which industry is most interested.

In some of the PLAs reviewed for this study, the licensee has further matured the DoD technology leading to commercialization of a product. However, in many of the PLAs reviewed, the licensees are still making progress to that end. It can take significant resources and many years of further development to transition a DoD technology to a commercial product.

In the future it would be interesting to track the path of a number of DoD technologies through the marketplace to determine how many of them find their way into DoD acquisition systems, for this would be an indicator of the return on investment DoD is realizing from licensing. However, for a study of this kind, a large sample size would be necessary to result in a relevant number of PLAs where the information would be available and accessible. The POCs from the federal and licensee sides would need to be available as well as individuals with the knowledge

of the various hand-offs that occur throughout the commercialization process. There are fewer Federal scientists and engineers with experience in patenting technologies, for these individuals, who are perhaps more innovative than the norm, are leaving the Federal Government for private industry. In addition, it would be interesting to track PLAs by year to determine, on average, how long it takes for a DoD technology to become a commercial product. Perhaps this timeline varies by specific technology area. It would also be interesting to determine the percentage of PLAs that result in commercial products and the percentage of PLAs that are negotiated for internal research purposes.